AFRL-IF-RS-TR-2005-367
Final Technical Report
October 2005

MOVING TARGET INFORMATION EXPLOITATION ELECTRONIC LEARNING

FTL Information Technology, Inc.

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

**AIR FORCE RESEARCH LABORATORY
INFORMATION DIRECTORATE
ROME RESEARCH SITE
ROME, NEW YORK**

STINFO FINAL REPORT

This report has been reviewed by the Air Force Research Laboratory, Information Directorate, Public Affairs Office (IFOIPA) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be releasable to the general public, including foreign nations.

AFRL-IF-RS-TR-2005-367 has been reviewed and is approved for publication

APPROVED: /s/

BRIAN O'HERN
Project Engineer

FOR THE DIRECTOR: /s/

JOSEPH CAMERA, Chief
Information & Intelligence Exploitation Division
Information Directorate

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE OCTOBER 2005	3. REPORT TYPE AND DATES COVERED Final Jan 02 – Dec 04

4. TITLE AND SUBTITLE
MOVING TARGET INFORMATION EXPLOITATION ELECTRONIC LEARNING

6. AUTHOR(S)
Anthony Spina

5. FUNDING NUMBERS
C   - F30602-03-C-0069
PE - 63260F
PR - 3479
TA - 3B
WU - A2

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
FTL Information Technology, Inc.
502 Court Street
Suite 241
Utica New York 13502

8. PERFORMING ORGANIZATION REPORT NUMBER

N/A

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Air Force Research Laboratory/IFEA
525 Brooks Road
Rome New York 13441-4505

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

AFRL-IF-RS-TR-2005-367

11. SUPPLEMENTARY NOTES

AFRL Project Engineer: Brian O'Hern/IFEA/(315) 330-3995/ Brian.Ohern@rl.af.mil

12a. DISTRIBUTION / AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 Words)*
The objective of the MTIX E-Learning contract was to develop and deliver electronic On-Line Learning (OLL) capabilities for Moving Target Information eXploitation (MTIX) users and operators. OLL allows MTIX users to have their own personal mentor 24 hours a day.

14. SUBJECT TERMS
Computer Based Training, Learning Objects, Moving Target, Information Exploitation, Electronic Learning

15. NUMBER OF PAGES
30

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

Table of Contents

List of Figures

Introduction

The objective of the MTIX E-LEARNING contract was to develop and deliver electronic On Line Learning (OLL) capabilities for Moving Target Information eXploitation (MTIX) users and operators. OLL allows MTIX users to have their own personal mentor 24 hours a day. The MTIX users/operators are an important and essential part of the Air Force Command and Control Intelligence Surveillance Reconnaissance (C2ISR) Enterprise. The "Enterprise" allow war fighters to execute the war plan with current and timely information. The scope of this program is to investigate electronic learning techniques and apply these proven techniques to the total MTIX functionality. Recently, software to develop electronic learning techniques has evolved from a research and development baseline to state of the art off the shelf commercial standard software packages. For example, Macromedia Flash MX allows designers and developers at FTL to integrate video, text, audio, and graphics into rich experiences and visual presentations that deliver superior results for interactive e-Learning user interfaces. Enhanced tools like Flash make it possible to create animation, add interactivity and incorporate multi-media assets. In addition, this technology allows FTL to create an environment, which allows MTIX users to be trained while being online performing their daily functions. MTIX users daily military function is to track targets, disseminate and gather additional information, determine projections and intent, deduce the target ID, and finally, to select the target and send that targeting information (with updates) to the command and control system for weapon-target pairing and attack.

The MTIX system provides a client/server infrastructure, which processes, catalogs, and exploits ground-moving targets and then disseminates the resulting high value data products to web-based users via the Secret Internet Protocol Router Network (SIPRNET). When integrated with the real-time data feed from ISR collection platforms or simulators, MTIX enhances Time Critical Targeting (TCT) by providing real-time tracking of multi-platform Moving Target Information (MTI), multi-INT receipt and association, and dissemination of TCT targeting information. Additionally, MTIX aids in the Intelligence Preparation of the Battlespace and Predictive Battlespace Awareness by providing cueing and cataloged product retrieval for subsequent exploitation.

The MTIX workstation fundamentally provides the ability to reason at the tracker level on MTI information as well as at the aggregate level across the MTI, Electronic Intelligence (ELINT), Unattended Ground Sensor (UGS), Overhead Non-Imaging Infra-Red (ONIR), and Synthetic Aperture Radar (SAR). Additionally MTIX will provide the ability to establish sentinels around areas of interest, such as Target Areas of Interest or monitor movement along key lines of communication. The MTIX application will allow users to analyze traffic flow patterns of an adversary's movement.

Cataloging is defined as the process of collecting, indexing, and storing data in a form that is efficient to query and retrieve. The MTIX architecture is extremely scalable which is necessary to support additional clients as data requirements grow. MTIX can ingest and store data provided in NATO EX or STANAG 4607 format, as well as previously recorded history files. The MTI reports are then processed by one of three trackers

(Kinematics Auto Tracker (KAT) is used most often for wide area surveillance) to produce track reports, which are then stored and indexed in a separate track database. Upon completion of ingest and tracking processes, the data is cataloged in the spatial/temporal catalogs and then displayed on the MTIX tactical display.

Background

This dynamic and progressive modernized learning aid as developed and delivered by FTL will greatly enhance the ability of the MTIX users to monitor and track targets of interest. E-Learning includes Computer-Based Training (CBT), Web-Based Training (WBT) and Electronic Performance Support Systems (EPSS). CBT is a type of education in which the student learns by executing special training programs on a computer. CBT is especially effective for training people to use computer applications because the CBT can be integrated with the applications so that students can practice using the application as they learn. WBT provides the ability to present a variety of training resources, which go beyond just text and graphics. Using a web-based approach allows you to: present information, show examples and illustrations utilize multimedia resources, create active learning tasks, assess participant understanding, track participants progress, and provide individual communication, feedback and discussion EPSS is an integrated electronic environment that is available to and easily accessible by each user and is structured to provide immediate, individualized on-line access to the full range of information, software, guidance, advice and assistance, data, images, tools, and assessment and monitoring systems to permit job performance with minimal support and intervention by others. As with any software with specific application, such as MTIX, it is important to provide training for personnel and customers, as well as a means for students and consumers to learn and refresh their professional skill at will.

The e-Learning function has been successfully fielded with multiple AFRL/IF software releases, which are currently operational. E-Learning differs from traditional training, in that the application is delivered on demand rather than on a specific schedule, so learners can take the curriculum when needed and at their own pace. E-Learning is a form of instructional authoring that can be delivered through a CD-ROM, over the LAN, or on the Internet. FTL Information Technology, Inc. has successfully developed and delivered e-Learning techniques to AFRL /IF over the past ten years, these programs include; MTIX e-Learning V1.0, Disaster Recovery Program (DRP), JView API and Audit Trail Viewer (ATV), Project Broadsword, Target Under Trees – Enhanced Intelligence Fusion System (EIFS), Predictive Awareness & Network-centric Analysis for Collaborative Assessment (PANACIA), and Non Traditional – ISR WebTAS – e-Learning.

   MTIX e-Learning V1.0 - under a previous subcontract to L-3 Communication Analytics Corporation, FTL delivered to AFRL/IFEA the MTIX Version 1.0 e-Learning application which was very successful and "well received" by the MTIX user community. The MTIX 1.0 program provides the 93rd ACW Joint Operational Intelligence Center (JOIC) at Robins AFB, the Combined Air Operations Center – Experimental (CAOC-X) at Langley AFB, and the Rear Air Operations Center (AOC) at

Nellis AFB with the MTIX client/server hardware and functionality as a certified and accredited operational system. The three sites have Secret Internet Protocol Router Network (SIPRNET) connectivity to exchange exploitable MTI data between and within each unit. The MTIX 1.0 system transitioned MTIX from the Dynamic Moving Target Information Exploitation (DMTIX) functional prototype to an operational system deployed to three Air Force sites. Specifically the FTL e-Learning methodology supported the following MTIX V1.0 system capabilities.

- Receive, process, catalog, store, and exploit Joint STARS MTI and SAR products received from a UHF SATCOM link.
- Receive, process, catalog, store, and exploit any other ISR sensor MTI products received from a UHF SATCOM or a secure LAN (i.e. SIPRNET).
- Receive, process, catalog, store, and exploit simulated Joint STARS (VSTARS) and Global Hawk MTI and SAR products received from UHF SATCOM (VSTARS only) or a secure LAN connection.
- Provide automatic tracking using Kinematics Auto Tracking (KAT) on all MTI.
- Ability to create, modify, select, or delete area sentinels which provides a traffic movement analysis tool alerting the operator to changes in expected target movement into and out of a selected area.
- Provide traffic flow analysis tools to analyze movement pattern to determine lines of communication tendencies and characteristics.
- Provide sensor visibility tool to highlight areas that the sensor cannot "see".
- An updated MTIX Mission Tool for easy start up in real time, history replay, or batch (process post mission data) modes. This includes an Admin Tool to process historical and real time databases in an efficient manner.
- Provide a capability to transfer and receive MTIX products between remote servers and clients through the SIPRNET or a secure LAN.

Disaster Recovery Program (DRP) – under subcontract to Northrop Grumman Mission Systems, FTL delivered to AFRL/IFEB the DRP e-Learning Navigation Guide. The Department of Defense (DOD) relies heavily on information technologies to conduct business, manage activities, and execute operations. Consequently, information assurance has become increasingly important to guard against the loss of data and ensure its recovery in the event of a disaster. The need for DoD "disaster recovery" is being addressed by the Department of Defense Intelligence Information Systems (DoDIIS) through sponsorship of programs that will assist various DoD sites in developing and implementing disaster recovery plans that will provide data recovery in the event of a disaster.

Specifically the FTL e-Learning methodology supports system administrators at the following DoD sites; USTRANSCOM, USNORTHCOM, USCENTCOM, Patrick AFB, Wright-Patterson AFB. Specifically the DRP Navigation Guide has the following features.

- **Opening Page**
  - o Command logo
  - o Title

3

- Images
- Enter Navigation Guide
- About Navigation Guide
- Disclaimer
- Date
- DRP logo and slogan

- **Navigation Guide Page**
  - Search
  - Acronym List
  - Contents

- **About DRP**
  - DRP Overview
  - DRP Process
  - Points of Contact

- **Site Documents**
  - Site Survey Report
  - List of Materials
  - Command Solution
  - Site Preparation Requirements and Installation Plan
  - Test Plan

- **Vendor Documentation**
  - DELL
  - NetApp
  - Cisco Systems
  - Sun Microsystems

     JView API and Audit Trail Viewer (ATV) - are government-owned and available free of charge to government agencies and their contractors. ATV was created as a replacement for IVIEW 2000 and was initially developed to support the display of air engagement simulations at the National Air Intelligence Center at Wright-Patterson AFB, OH. The ATV allows visualization, playback, and analysis of a variety of recorded simulation file types. The ATV was built using the JView Application Programmers Interface (API). JView is a 3D runtime configurable and platform independent visualization API upon which robust applications can be built. User interaction with the 3D environment can be performed using the keyboard, mouse, and, optionally, Logitech's Magellan 3D input device. The ATV has three different camera positioning tools. The Observer View is a free flight mode which allows the user to position themselves at any point in space, the Trail Behind mode follows a chosen entity, and the Orbit View which follows the selected entity and allows the viewer to orbit around it to any desired look-angle. The current version of the Audit Trail Viewer is being supported at the same time as new features are being developed. Such features include the ability to handle new data input formats, generate movies (mpegs), and the loading of the National

Imagery and Mapping Agency's (NIMA) products such as Digital Terrain Elevation Data (DTED). In support of AFRL/IFSB in-house efforts, FTL developed an e-Learning technique, which trains NAIC analyst to view aircraft models, enable fictional terrain, and display past and future trails while avoiding foreign threats.

Project Broadsword - is an effort to provide an extensible framework of services and tools, which help a user, gather intelligence information from distributed data sources in support for his/her mission. Broadsword is middleware package that will bring a number of applications together. The goal is to provide a single, secure interface enabling access to information that can exist anywhere. Broadsword provides access to existing information available on JWICS, SIPRNET and NIPRNET. Through a common web interface such as Netscape or Internet Explorer, users can effortlessly access diverse information resources, perform intelligent searches, and visually display the results in a manner that aids and simplifies the decision-making. The FTL e-Learning program specifically satisfied the Department of Defense Intelligence Information System (DoDIIS) mandated training requirements, as documented in DoDIIS Instruction 2000 dated February 2000, in the area of online application training. Broadsword e-Learning techniques developed by FTL take place in the context of command centers wherein every command center performs four basic functions: (1) monitoring a situation, (2) assessing its progress against mission plans, objectives, and metrics, (3) planning actions to accomplish assigned mission, and (4) executing plans in a dynamic environment. Command Centers monitor the situation by gathering information from the operating environment, including information about not only the enemy but also their own forces. Decision-makers assess the mission progress by applying the context of the assigned mission and the commander's guidance. Commanders plan actions to favorably shape the situation in the operating environment, which is consistent with the mission and available force capabilities. War-fighters execute the plans or courses of action selected by the commander.

Target Under Trees – Enhanced Intelligence Fusion System (EIFS) Project - Under this project FTL developed e-Learning techniques, which provide a TUT/EIFS operator the necessary information to properly, operate a TUT/EIFS system. The TUT /EIFS is being developed in a series of 6-month spirals. Spiral 4 supports the ingestion of data files built with live or simulated data from Moving Target Indicator (MTI) sensor data in NATO-EX format, Foliage Penetration (FOPEN) change detection reports, Advanced Synthetic Aperture Radar System (ASARS II) images in National Imagery Transmission Format (NITF) 2.0 or 2.1, Electronic Intelligence (ELINT) reports using the TAB 37 format, and basic display information from the Automated Assistance to Intelligence Preparation of the Battlespace (A2IPB). This information is forwarded to the Processor Independent Correlation Exploitation System (PICES), the Precision Strike Tracker (PST), and the Fusion Manager. The Intelligence Extraction Processing Subsystem (IEPS) component provides a database of Human Intelligence (HUMINT) reports accessible by WebTAS to the operator. Moving Target Indicator Exploitation (MTIX) will be used in Spiral 4 in place of PST a translator has been created to subscribe using a catalog client to MTIX Extended Markup Language (XML) documents and translate the XML to an XDA MTI track ontology. For Spiral 4, this translator publishes

MTI tracks using XDA 4.1A but the Fusion Manager does not subscribe to these tracks. These components generate a series of tracks that are sent to WebTAS for display.

Predictive Awareness & Network-centric Analysis for Collaborative Assessment (PANACIA) - Under this project FTL addressed the training challenges of an operator focused on analyzing multiple intelligence. PANACIA exploits a multitude of different data types from many platforms and sources. The PANACIA solution delivered an integrated workstation with dual displays and reasoning capabilities focused on exploiting information from track-level to complex behaviors. The solution is tailored to meet functional needs and operational requirements of a wide set of users. FTL is implementing innovative e-Learning techniques to facilitate acceptance of the new paradigms associated with the powerful PANACIA new fusion capability.

Non Traditional - ISR WebTAS – eLearning - Timely analysis of intelligence data is invaluable for determining the intentions of a potential adversary. The more data you analyze, the more accurate your conclusions will become. With automated data handling systems, collecting and storing large volumes of intelligence data is a straightforward task; however, providing the capability to interactively extract and redirect very specific subsets of the data is not as simple. It requires knowledge of the database design, the nature of the database tables and their inter-relationships, and the Structured Query Language (SQL) used to query the data in the database. The WebTAS software application acts as an intermediary, providing comprehensive software tools that enable you to do all the above, and more. The User's Manual is a comprehensive guide containing procedures for using the Web-enabled Timeline Analysis System, or WebTAS, a suite of software tools that facilitate the application of temporal analysis. Temporal analysis is a methodology that can be employed by analysts to improve the efficiency and effectiveness of situation assessment and prediction. FTL developed e-Learning techniques to augment classroom training.

After the initial development, e-Learning can save training expenses, because it can be used over and over again. E-Learning also allows the user to study at his or her own convenience, without the necessity of scheduling times for classes. Instructors do not need to be present when it is being used. Also, everyone is following the same curriculum. See the conclusion of this document for other specific e-Learning benefits.

MTIX e-Learning Technical Requirements

Under contract F30602-03-C-0069 entitled "MTIX E-LEARNING", the statement of work required FTL to perform the following tasks over a 30-month period.

1. Develop and test MTIX e-Learning tools.

2. Analyze Government provided user handbooks, software documentation, and associated screen captures for the MTIX suite of software tools.

3. Government provided information includes; MTIX Installation & Configuration Guide, MTIX User's manual – Server Toolset, MTIX User's Manual – Client

Toolset, MTIX System Security Authorization Agreement (SSAA), MTIX Security Test Plan, and MTIX Interface Control Document (XML, Tracker), System Segment Specification, Test Procedures, Test Plan, Operator Checklist, Maintenance Manual, Database Design Description (DDD), Software Design Description (SDD).

4. Design and develop the methodology for the development and authoring of e-Learning, which includes Computer-Based Training (CBT) and Web-Based Training (WBT) material.

5. Design and develop appropriate graphical user interface look and feel for the specific MTIX e-Learning application.

6. Evaluate the following when designing the e-Learning methodology.
    - Measurable objectives
    - Upgrade path and maintainability
    - Provide clear and consistent instructional design of the material
    - Emphasize instructional goals, as opposed to entertainment
    - Provide intuitive and easy method to navigate user interface
    - Provide for ongoing and purposeful interaction with and by the student
    - Real-world applications, exercises and examples are necessary
    - There must be an effective and systematic assessment of student progress and achievement

7. Utilize multimedia primarily to effectively communicate content and motivate learning.

8. E-Learning techniques should improve user roles, educational level, sensor familiarity, and computer familiarity.

9. Analyze Government review comments of the methodology and incorporate this feedback into the final methodology for implementation.
10. Author the e-Learning materials utilizing the methodology designed.

11. Analyze Government comments following their review of the e-Learning alpha version and incorporate this guidance and feedback into the design and implementation of the final MTIX e-Learning deliverable. All comments and change request will be designed and developed into the final version of the MTIX e-Learning application.

12. Review, validate, and test all MTIX e-Learning capabilities.

13. Deliver the final version of the e-Learning application with all tools necessary for maintenance and updates.

14. Deliver all computer software developed and assembled.

15. Other technical requirements include feedback from the AFRL JEFX-04 Predictive Battlespace Awareness/Effects Based Operations initiative. Furthermore, the Air Force Command and Control Intelligence Surveillance and Reconnaissance Center communicated formal assessment at the PANACIA bidders brief. Key in this assessment was the fact that a true multi-INT fusion capability is highly desirable. It was nice to have multi-INT tracking functionality, but the Senior Intelligence Duty Officer (SIDO) wanted actionable holistic situation awareness and predictive capabilities. Several issues precluded this capability from being fully exercised. Some of these issues were doctrinal, and identified in the after action reports, see below.

- Insufficient training for mutli-intelligence analysts.
- Automated predictive analysis is an emerging capability and not a currently accepted paradigm. This clearly points to the need for an intuitive design with associated training materials that foster a complete understanding of the application of such a system.
- Existing methods for the generation and continuous maintenance of the Intelligence Preparation of the Battlespace products were not acceptable.
- From a user interaction perspective, the system did not present an adequate means of allowing operators to express their information needs from the lowest level tracks, through echelon aggregation, to behavioral cues of interest. The operator was forced to rely on a non-integrated collaboration capability, constantly switching between a limited Internet Relay Chat (IRC) capability and the SAS screen. The chance for error through mistranslation of data or transposition of coordinates was great.
- There was no ability to coherently view, in three-dimensional space, where sensors were relative to the fused intelligence picture, nor the ability to easily infer things such as target visibility or obscuration due to terrain.
- There was no capability to allow the operators to effectively contextualize mutli-INT information.
- Lastly there was no automated aggregator of information of interest for the operator, when they wanted data it was largely an info pull/query paradigm.

MTIX e-Learning Technical Process and Results

FTL's software engineering process and approach to developing e-Learning techniques for the United States Air Force is driven and influenced by the National Learning Infrastructure Initiative (NLII). Results from FTL's approach have been unique and very successful. NLII's goal and mission is to develop an open architecture for online learning. The NLII membership includes Universities, Microsoft, Apple, IBM, SUN, etc., National Institute of Standards and Technology (NIST), and Department of Defense (DoD).

Key to the FTL approach is identifying and implementing learning objects. NLII definition: A "learning object" is a "modular digital resource, uniquely identified and metatagged that can be used to support learning." "Learning objects vary in size, scope, and level of granularity ranging from a small chunk of instruction to a series of resources combined to provide a more complex learning experience."

FTL's process to develop and deliver a MTIX eLearning capability consists of the following internal and proven processes:

1. Read, study, and understand government provided MTIX documentation and software, the following government documentation was provided to FTL for this particular contract:

   Joint ACCESS - System Segment Specification dated 9 January 2004. This document established the Army Tactical Exploitation System (TES) requirements for an integrated Joint ACCESS system as part of the TES system. The Joint ACCESS system provides a Joint STARS MTI receives and display function for the eight assigned Army TES units. The Joint STARS data will be received via Line of Sight SCDL feed. Incoming data will be received by the TMSS system, converted to NATO EX format and broadcast to the MTIX system. MTIX runs on the Multi-Function Workstation and passes selected tracks to the TES Integrated Tactical Display.

   Joint ACCESS - Test Procedures dated 13 January 2004 Revision A. The purpose of this procedure described the test approach for checkout and testing of the Joint ACCESS system as part of the Army TES IWO. This Test Procedure sets the scope of system testing and what activities will have to be completed in order to successfully prepare the Joint ACCESS system for integration into the Army TES architecture. The primary objectives of this document are:

   - To provide a coherent view of the required test activities;
   - To outline the testing process;
   - To detail the Quality Assurance involvement in the testing;
   - To outline responsibilities of each involved team member;
   - To outline how the results will be reported;
   - To discuss possible issues and/or risks to the test activities

   Joint ACCESS - Test Plan dated 9 January 2004. The purpose of this plan is to describe the test approach for checkout and testing of the Joint ACCESS system. This Test Plan is intended to form the basis for testing the Joint ACCESS MTI portion of the Northrop Grumman Electronic Systems (NGES) Army TES Factory Acceptance Testing (FAT). This Test Plan sets the scope of system testing and what activities will have to be completed in order to successfully prepare the Joint ACCESS system for integration into the Army TES architecture. The primary objectives of this document are:

- To provide a coherent view of the required test activities that will support the NGES FAT
- To outline the testing process
- To outline the testing scope

Joint ACCESS - Training Plan dated 3 June 2004. Moving Target Information Exploitation (MTIX) is one component of the Combat ACCESS (Advanced C2ISR Exploitation and Surface Strike) system, which includes MTIX and a TMSS (Transportable Mission Support System). MTIX provides the MTI exploitation, data distribution, and a C2ISR interface, while the TMSS provides the Joint STARS communications interface. This Joint ACCESS Training Plan covers the required elements to execute a training session for system operations, maintenance, and troubleshooting. The primary focus is to train field operators on the MTI exploitation piece of the TES.

MTIX Operator Checklist dated 28 July 2004. This checklist formats MTIX functions into steps, actions, and events for MTIX operators.

Joint ACCESS - Software Version Description dated 9 January 2004. This document describes the MTIXv2.0 release of the Moving Target Information Exploitation (MTIX) for Joint ACCESS.

Joint ACCESS - Installation Procedures Revision A dated 4 June 2004. This procedure is applicable to MTIX Server software and describes the steps necessary to install or update MTIX software. This procedure does not cover the installation of java client software or client underlay files.

Joint ACCESS - Maintenance Manual Revision A dated 27 July 2004. This manual addresses maintenance and troubleshooting concepts for the Joint ACCESS system. It is broken into two major sections, one for TMSS and one for MTIX.

Joint ACCESS - System Manual Revision A dated 3 June 2004. This Joint ACCESS System Manual provides information necessary to understand and utilize functions of the operational installation of the system hardware for Moving Target Information Exploitation (MTIX) and the Transportable Mission Support System (TMSS).

Joint ACCESS – MTIX Users Manual Revision A dated 2 June 2004. The MTIX User Handbooks provide information necessary to understand and utilize functions of Moving Target Information Exploitation (MTIX) portion of the Joint ACCESS system. Joint ACCESS is composed of a Transportable Mission Support System (TMSS) portion, which handles external communications processing, and MTIX, which provides the Ground Moving Target Information (GMTI) exploitation. This MTIX User Handbook describes the MTIX architecture, components, and user interface as it relates to the Server-Side operations. This volume is divided into three main sections. Section 1 provides a general introduction of the MTIX system and its operational integration. Section 2 provides a detailed overview of the MTIX

architecture and components. Section 3 provides a description of the user interface and functionality of the Server portion of the MTIX system.

MTIX Software Design Description (SDD) dated 9 January 2004. This document describes the design of the MTIX CSCI of TES. The design implements the requirements contained in the corresponding MTIX Software Requirements Specification (SRS) for the TES Program, Statement of Work (SOW). Section 1 provides an identification of the document, and an overview of the system and MTIX software. Section 2 references other documents applicable to this Software Design Description (SDD). Section 3 discusses design decisions affecting the selection and design of the software units that make up the CSCI. Section 4 describes the CSCI architectural design. Section 5 describes the detailed design of each software unit of the CSCI. Section 6 addresses requirements traceability. Section 7 contains notes as appropriate. Finally, the last section (non-numbered) contains the appendices.

MTIX Database Design Description (DDD) dated 9 January 2004. This document describes the characteristics of the databases used by MTIX system. Section 1 provides an identification of the document, and an overview of the system. Section 2 references other documents applicable to this DDD. Section 3 discusses the database characteristics. Section 4 addresses requirements traceability. Section 5 contains notes.

Configuration Management Plan (CMP) dated 9 January 2004. The purpose of this Configuration Management Plan is to describe the methodology by which the Joint Access (JAC) program will implement Hardware Configuration Management (HWCM), Software Configuration Management (SCM) and Data Management (DM). This Configuration Management Plan (CMP) has been prepared in accordance with HCM/SCM/DM best industry practices and company internal standards as tailored for the Joint Access program. The procedures and processes documented herein will identify, control, record, and report the HWCM, SCM and Data Management activities associated with the Joint Access program.

2. Execute and operate MTIX software application internally at the FTL labs on an Ultrasparc III laptop computer, mobile server and in the AFRL/IFEA Fusion Laboratory when necessary. Technical interchange meetings and quarterly program reviews were conducted with the government and the MTIX software developer to resolve software and documentation issues to assure MTIX e-Learning correctness.

3. Become a proficient MTIX user capable of executing all MTIX functions. FTL software developers must become MTIX users prior to designing, coding, and testing MTIX e-Learning software.

4. Design Graphic User Interface (GUI) look and feel using state of the art e-Learning research results.

5. Design learning objects and their associated sub steps. This includes story boarding, identify individual frames, and program the necessary animation.

6. Use Photoshop to enhance MTIX screenshots when necessary.

7. Populate and link the MTIX e-Learning design (GUI & Learning Objects) with each individual learning object.

8. Conduct in-house MTIX e-Learning testing and quality assurance in FTL labs.

9. Deliver MTIX e-Learning alpha version to MTIX PMO for review.

10. Incorporate MTIX PMO feedback and direction into existing alpha version.

11. Conduct in-house MTIX e-Learning testing and quality assurance in FTL labs.

12. Deliver MTIX e-Learning final version to PMO.

MTIX e-Learning V2.0 enhancements were implemented based on MTIX software capabilities and are discuss below.

- Graphical User Interface (GUI) look and feel enhancements (see figure 1) to improve user interactivity and navigation. Left side of screen contains e-Learning navigation aids and help options. The right side of the screen emulates the MTIX V2.0 software as each learning object is launched.

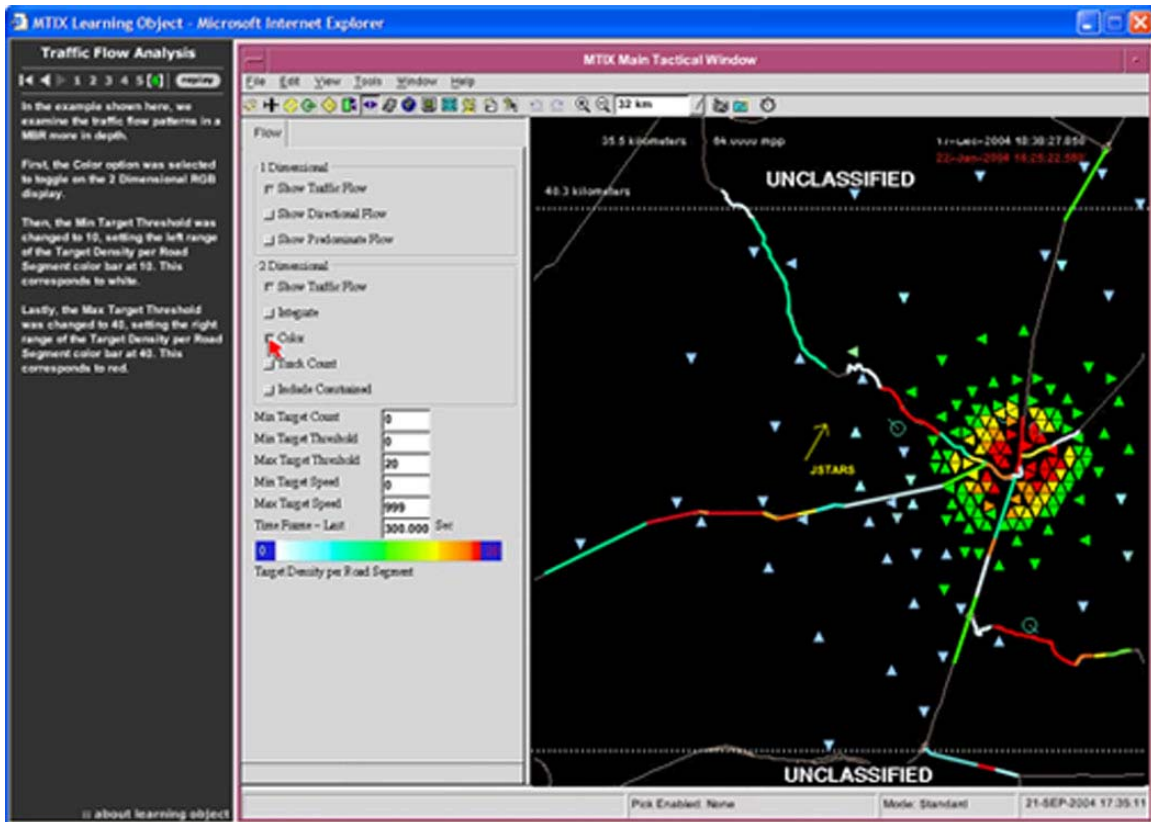- Screen resolution was improved from 800x600 pixels to 1024x768 pixels.

Figure 1. Graphical User Interface (GUI) look and feel enhancements

FTL scientists and software engineers identified the learning objects and their associated sub steps from government provided documentation. Below are the MTIX learning objects that were delivered to AFRL/IFEA.

Real Time Mission Start Up: The default mode for the Mission tab is the Real Time setting. In this mode you can start MTIX for the monitoring and exploitation of live missions in real time, as well as running the MTIX simulation mode for real time training purposes.

- Enter Mission Number
- Select Mission Area
- Load Configuration Files
- (Optional) Real-Time Simulation to replay existing Joint Stars Mission
- Select Real Time will enable starting and stopping the simulation file

Mission Replay: The mission replay functionality provides the operator the option to play back a previously recorded mission. When the operator selects a mission for playback, the display will automatically appear with that mission loaded.

- Select desired replay mission name
- Select the mission area
- Select replay mode

Batch Run: Occasionally there will be times when a Joint STARS mission file will be available outside of MTIX, and it is desired to process the file through MTIX to take advantage of its exploitation capabilities. This is accomplished by executing a Batch Run. Batch Run requires the input of a New Mission number/name, the Mission Area, and loading a configuration file (requiring the operator to know the Platform ID).

- Select New Mission, enter batch run mission name, and select the batch run check box.
- Select the Mission Area
- Select Load Configuration
- Select Batch Run
    - Select a File Format
    - Select Input File
    - Select Appropriate Platform
    - Select the Desired Output Products
    - When the Processes Complete Running, Select Exit

Ultra – High Frequency (UHF) SATCOM Operations: Once the SATCOM display window appears, the system will begin receiving MTI data from Joint STARS.

- Select the Host Name
- Select Mission Area
- Select Run Serial Trace or Run LAN Trace
- Establish the SATCOM Link
    - Enter Call Sign
    - Select Link-Connect
    - Select Link-Promiscuous

Surveillance and Control Data Link (SCDL) GUI Operations as Related to MTIX: This learning object trains the MTIX user on how to activate the Surveillance and Control Data Link.

- Select the Host Name
- Select the Mission Area
- Select Run LAN Trace
- Check Status

Real-Time Tactical Display: Operations here provide the tools for real-time exploitation of live MTI data from Joint STARS and/or other ISR sensor feeds.

- Select a Process to Run
- Zoom in/out capability
- Panning capability
- Icon Toolbar
- Select a Tab
- Display Features
    - Coordinate Position
    - Time Groups

Moving Target Information (MTI) Functions: This learning object shows how to set the options for MTI entities displayed on the tactical display.

- Set options for displayed entities
- Display all MTI collected over selected time period
- Show in/out bound MTI
- Tracked or wheeled based of Doppler return
- Show good/bad velocity
- Fade history option
- Show sub frame MTI count
- Show MTI Location Uncertainty
- Show Color
    - Inbound/Outbound
    - By Platform
- Enable pick amplifies selected information

Platform Functions: The Platform tab sets the options for display of sensor platform related information, and includes platform navigation data.

- Select Platform Icon
- Show Platform ID
- Show Field of View
- Show Radar Boresight
- Show Flight Path History
- Enable Picks
- Show Platform Navigation Data

Radar Service Request (RSR) Functions: Represents the areas where radar jobs are occurring.

- Select the RSR Icon
- Show RSR Header Information
- Show RSR Type
- Show Radar Reference Coverage Area
- List each RSR Received
- RSR Creation

       o   Select Platform
       o   Fill Out the Window
       o   Enter Positional Data
       o   Select Enable Pick – Select Point
       o   Select Send

Track Functions: Explains the functionality used to create tracking filter areas, establish filters and select a track area.

- Select the Track Icon
- Select Area
- Create Track Area
- Ground Reference Coverage Area
- Show Track ID / Show Track Counts
- Show Track Group ID / Show Group Track Count
- Show Position Uncertainty
- Show Confirm Tracks / Show Tentative Tracks
- Minimum Number of Good Returns
- Clear Track History
- Enable pick / Select a Track Entity

Joint Tactical Information Distribution System (JTIDS) Functions: This learning object provides an overview of the JTIDS tab and its filter functions.

- Select JTIDS Icon
- Show Ground Track / Point
- Show MTIX Nominated / Show Timed Out
- Show Speed / Heading / Position
- Purge Remote JTIDS / Clear JTIDS History
- Nominate MTIX Track

Nominating MTIX Tracks to JTIDS: Learn how to nominate MTIX Tracks to JTIDS.

- Nominate MTIX Track Option
- Select Desired Track
- Select Create Ground Point
- Drop MTIX Nominated / Create

Editing Nominated Tracks: Learn how to edit MTIX JTIDS Nominated Tracks.

- Select the Modify MTIX Nominated / Created Pick Option
- Make Appropriate Changes to the JTIDS Track
- Select Apply for Changes to Take Place
- Select Close when Done

Sentinel Functions: The Sentinel tab opens the filters that allow the operator to create, edit, and activate sentinels.

- Select Sentinel Icon
- Show Labels, Description, Alerts
- Select Sentinel Area Option or the Manual Point Input Option

Create Sentinel Area (Graphic Pick): Learn how to create a Sentinel using the "Select Sentinel Area (Graphic Pick)" option.

- Select Sentinel Area (Graphic Pick) Option
    - Circle, select the Radius button, and enter the radius in the field along with the Center Position. Select Return/Enter to have the data appear in the bounding area field.
    - Square, select the Square button, and enter the square length (in KM) from the center point, along with the Center Position. Select Return/Enter to have the data appear in the bounding area field.
    - Polygon, select Manual Point Input to activate the add Position field. Enter the vertex point in the desired format and select Return/Enter.
- Enter a Label and Description for the Sentinel.
- Select the Alert Criteria from the three entry fields.
- Select Accept.
- Select the Show Alerts Option.

Create Sentinel Manual Point: Learn how to create a Sentinel using the "Manual Point Input" option.

- Select the Manual Point Input Option
    - For a Circle, Select the Radius Button
    - For a Square, Select the Square Button
    - Press return / Enter to have the Data Appear
    - For a polygon, Select Manual Point Input
- Enter a Label and Description
- Select the Alert Criteria
- Select the Accept Button
- Select the Show Option

Editing a Sentinel: Learn how to edit a Sentinel.

- Select the Sentinel
- Right Click on Select Sentinel

17

- Select Show
- Select Info
- Select Activate/Deactivate
- Select Toggle Alerting
- Select Modify
- Select Delete to delete a sentinel from the database.

Traffic Flow Analysis: This learning object provides a detailed view of the Traffic Flow tab and its tools to enable automated movement analysis.

- Select the Traffic Flow Icon
- The One Dimensional Section
    - Shows Traffic Flow
    - Shows Directional Flow
    - Shows Predominate Flow
- The Two Dimensional Section
    - Shows Traffic Flow
    - Provides Integrate Option
    - Provides Color Option
    - Provides Track Count Option
    - Includes Constrain Options
- The Filter Parameters Help Define Automated Movement Analysis
    - Min Target Count
    - Min Target Threshold
    - Max Target Threshold
    - Min Target Speed
    - Max Target Speed
    - Time Speed
- Select Color Bar
- Run Traffic Flow Analysis

Imagery Functions: Learn how to view Joint STARS SARs that have been down-linked to the TMSS, and load them to the display.

- Select the Image Icon
- Select an Individual SAR from the Available Images List
- Click the Load Button
- Show Images Pick Option
- Show Labels Pick Option
- Edit a SAR
    - Center on Image Button
    - Unload Image Button
    - Show Image Option
    - Blend Image Option
    - Unregistered Image Option

    o Enable/Disable Register Pick Option

Map Functions: The Map tab provide the functionality to underlay NGA based DFAD and CARDG type maps on the MTIX display.

- Select Map Icon
- Choose an Underlay
- Show Cartographic Features

Display Functions: Learn how to use the Display tab filter selections to set up the MTIX tactical display.

- Select the Display Icon
- Select Batch Delta Field in Seconds
- Select Show Subframe Info
- Select Show Rulers
- Go To Position Field
- Type In Position
- Press Return / Enter
- Display Update Rate
- Show On Display
- Click Enable Pick
  - Range/Bearing
  - Send Track to MTIX Report
  - Send JTIDS to MTIX Report
  - Send Display to MTIX Report

Annotations and Order of Battle (OOB) Functions: Learn how to annotate a particular point on the tactical display with operationally significant information, such as Order of Battle or stationary high value areas.

- Select the Annotations ad OOB Icon
- Clear Entry Fields
- Select Annotation Point Pick Option
- Select OOB Point Pick Option

Create Annotations: Learn how to create line, circle, or point Annotations on the MTIX tactical display.

- Select Annotation Point Pick Option
- Select the Type of Annotation
- Select the Color for Annotation
- Select the Symbol for Annotation
- Enter Annotation Description
- Select the Create Annotation Button

- Make Show Selection
- Select File-Save Annotation

Modify/Edit Annotations: Learn how to modify/edit line, circle, or point Annotations.

- Left Mouse Click on the Annotation to be Modified
- Right Mouse Click includes zoom, modify, delete, and delete all.
- Select Modify
- Edit Fields
- Select the Modify Annotation Button
- Select File-Save Annotations

Create OOB: Learn how to create Mil Std 2525 symbology on the MTIX tactical display.

- Select Show Options
  - OOB
  - OOB Name
  - OOB Description
  - OOB Force
  - Position
- Select OOB Point Click Option
- Right Mouse Click to Add an OOB Point
- Select the Symbol Option
- Select the Force
- Select the Friend/Foe from the Pull Down Options
- Enter the Name You Wish to Label the Annotation
- Enter Description in Description Box
- Select File-Save OOB

Modify/Edit OOB: Learn how to modify/edit Mil Std 2525 symbology.

- Click on OOB List to be Modified
- Right Mouse Click includes zoom, modify, delete, and delete all.
- Select Modify
- Change the Fields You Wish to Change
- Select Modify Order Of Battle Button
- Select File-Save Order Of Battle

Intelligence Functions: This learning object provides a detailed view of the Intel tab and shows how to receive intelligence data from multiple sources.

- Select Intelligence Icon
- Select the Enable Pick-Intelligence Amplifying Pick Option

- Select Track Id or Emitter Id Pick Options
- Emitter and Track Ids are Displayed

Free Text Functions: Learn how to create a free text message transmit and receive median for NATO EX Free Text broadcasts.

- Select the Free Text Icon
- Select the Store Option
- Select the Transmit and Store Option
- Select Broadcast Option
- Select Additional Input Boxes
- Select Send

Pick Functions: This learning object shows all "Pick" functions conveniently located in one location.

- Select the Pick Icon
- Selecting an Enable Pick Option Activates the Right Mouse Button for Interacting with the Tactical Display

Snap Shot Movie Control: Learn how to save a series of screen captures at a regular and frequent basis.

- Click the Snap Shot Movie Control Icon
- Select the Create Snap Shot Option
- Capture Criteria Dictates How Often to Grab an Image
- Store Files in Directory
- Click the Apply Button to Start the Process

History Replay: This learning object shows how to use the History Replay tab to develop traffic movement history and patterns.

- Select the History Replay Icon
- Review Position Information
- Change Display Parameters by Moving the Slide Bar
- Select Defined Range
- Select Sliding Window Option
- Select Display Information
- Select Playback Button

MTIX Report Tool: This learning object shows how to record and catalog Moving Target Intelligence information describing an operationally significant event and convey it to other agencies using an MTIX Report.

- Data Management Area Allows Predefined User Preferences

- Data Captures Allows Individual to Capture Images
- Select Text Input
- Select Open New MTIX Report
- To Create a New MTIX Report Click New Button

Server Database Reports Retrieval: This learning object shows how to open MTIX Reports that have been stored on the MTIX server.

- Select the Query Database Button and the MTIX Catalog Window Appears
- Input Latitude and Longitude Bounding Coordinates
- Select the Keywords Tab
- Select Desired Keywords
- Select Other Query Attributes by Checking Appropriate Check Box
- Select the Accept Button to Execute the Query
- From Query Results Window Select the Desired MTIX Reports

Data Management Section: This learning object shows how to enter or modify administrative data in the report.

- From the MTIX Report User Preferences Tab, Update the Fields as Desired
- Select the Accept Button to Save the Data
  - Select the Set Defaults Button
  - Select the Reset Button
- The Data is Automatically Updated
- Select Keyword That Best Describes the Category

Data Capture Section: This learning object provides an overview on the automated event capture to populate the fields with pertinent target information.

- The Images Tab is the First Tab of the Data Capture Section
  - Capture and Associate an Image to a Particular MTIX Report
- The Track Tab is the Second Tab of the Data Capture Section
  - Track Tab Uses Both the MTIX Report Tool and Pick-MTIX Menu Selections
- The Basic Encyclopedia Tab is the Third Tab of the Data Capture Section
  - BE Elements Can Either be Fixed or Temporary Entities and are Used in Cases Where a Track is Not Applicable

Image Capture: Learn how to capture and associate an image to a particular MTIX Report.

- Open the Display Tab and Set the Main Tactical Display to Desired Image
- Select the Send Display to MTIX Report Pick Option
- Right Click Anywhere on the Main Tactical to Capture it as an Image in the MTIX Report
- Capture Multiple Images
- To Delete Click the Delete Button

Track Capture: Learn how to capture information on a particular track to your MTIX Report.

- Open the Display Tab and Set the Main Tactical Display
- Under the Enable Picks Section, Select the Send Track to MTIX Report Pick Option
- Right Click on Desired Track
- Select the Activity Pull Down Menu, and Select the Appropriate Activity Title

Text Input Section: Learn how to annotate the MTIX Report to add operator insight and pertinent information to the data and images.

- From the Current Notes Tab of the Text Input Section You Can Add Information
  - To Save Select the Accept Button
  - Select Clear Button to Start All Over
  - Select Delete Button to Delete
- View All the Previous Textual / Image Updates that were Generated from that Original Report from the Previous Notes Tab

Conclusion

In conclusion, MTIX e-Learning educates MTIX software application users quickly, effectively, and economically. Students are now trained right at their desk. All that is needed is an industry-standard Internet browser (Netscape or Explorer) and a personal computer with Internet access or CD-ROM drive. Students now have the power to "learn and return," so they can immediately return to work and use their newfound skills and knowledge.   Typical components of e-Learning include exercises, scenarios, and simulations using still images, animation, video clips, and audio narration when necessary. These media rich exercises are fully capable of evaluation, adaptation, and correction. Computer-based training (CBT) delivered via the Internet, intranet, or CD-ROM is gaining wide acceptance. Here are seven reasons why:

(1) Cost effectiveness: Group classroom training takes time, and lots of it. Studies show that computer-based training reduces training time by as much as 48 percent. Slashing training time, eliminating travel time and expenses for learners and instructors,

and reducing facility and delivery costs all translate into significant improvements in training cost effectiveness.

(2) Browser based: You can train your employees via the Worldwide Web. Or if you have firewall or other security constraints, programs can be installed on your intranet and run entirely within your organization's computer system.

(3) Consistent, global delivery: The material presented will be consistent from training session to training session and from site to site, throughout the entire organization. This helps you meet compliance and security considerations as well as to be assured of the highest quality training to reduce incidents.

(4) Instant updates: Reach all learners simultaneously with updates, ensuring consistently up-to-the-minute training DoD-wide.

(5) Availability: With training available 24 hours a day, seven days a week, you can easily and conveniently schedule training around production demands and learners' work schedules, often eliminating the need for overtime to conduct training.

(6) Self-paced learning: An employee familiar with the subject but required to document refresher training can move through the material quickly. Conversely, learners who are more challenged with material are automatically directed into remedial or developmental training until they can prove comprehension. Either way, learners progress at their own pace, ensuring the highest comprehension and retention of important MTIX lessons. Well-authored self-paced programs deliver significant benefits to the end user by making training available on demand, by providing learning path ways that are uniquely suited for each user, and easily coordinated with other training curriculum.

(7) Interactivity: The interactive nature of well-designed CBT engages the learner as an active participant in training. Interactions throughout a program result in higher comprehension and retention. The instructional design of the course and interactions promote a transfer of knowledge from short-term to long-term memory. The FTL eLearning techniques allows the MTIX user to be in control of his own training, provide feedback/communication concerning their eLearning experience, become more productive, and allow for the user to easy adapt to his new learning environment.

According to research carried out at UCLA, a training visual presentation is five times more likely to be remembered after three days than a training presentation that uses bullet points.

The famous psychologist Albert Mehrabian, Ph.D., UCLA showed that the way people take in information during a training presentation is 55% visually, compared to 38% vocally, and only 7% through text.

Good software and good training will reduce Help Desk calls and direct calls to the Program Management Office. One of the first responses to a request from the user community should direct a caller to a specific MTIX learning object.

Good software and good training will reduce the onsite support requirement thus reducing the overall cost of the project.

An e-Learning package can augment classroom training. A student can be oriented to a new software application prior to classroom training. After formal classroom training the student would have the e-Learning package for future reference.